DOCUMENT RESUME

ED 267 705 HE 019 189

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TITLE A Comparison of Self-Paced and Lecture/Discussion Teaching Methods.
PUB DATE Aug 85
NOTE 31p.; Paper presented at the Annual Meeting of the American Psychological Association (93rd, Los Angeles, CA, August 23-27, 1985).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS College Instruction; Comparative Analysis; Conventional Instruction; *Course Evaluation; *Discussion (Teaching Technique); *Grades (Scholastic); Higher Education; *Lecture Method; *Pacing; Questionnaires; *Student Attitudes; Teaching Methods

ABSTRACT

Student course performance and course evaluation were compared for two methods of teaching general psychology. The self-paced method consisted of a modified Keller Plan (PSI) arrangement in which students progressed through small instructional units at their own pace. The lecture/discussion method consisted of a modified form of the traditional teaching style in which students were exposed to lectures and discussion that covered large units of information, and students proceeded at the instructor's pace. The results revealed little difference in course performance for the two teaching methods, except that the self-paced students performed better on the unit (chapter) tests. No differences were found between the two methods with respect to performance on the final exam, retention one year later, or average course grade. The results further reveal that the students were more satisfied with the self-paced courses than with the lecture/discussion courses. The evidence suggests that the general evaluation of the two courses favored the self-paced method. It is concluded that the self-paced course is not necessarily a better way to learn, but that students are more satisfied with the self-paced format than with the lecture/discussion style. The questionnaire is appended. (Author/SW)

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A Comparison of Self-Paced and Lecture/Discussion Teaching Methods

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Paper presented at the 93rd annual convention of the American Psychological Association, August 23 - 27, Los Angeles, CA

HE 019 189

Abstract

The study compared two methods of teaching general psychology with respect to student course performance and course evaluation. The self-paced method consisted of a modified Keller Plan (PSI) arrangement in which students progressed through small instructional units at their own pace. The lecture/discussion method consisted of a modified form of the traditional teaching style in which students were exposed to lectures and discussions that covered large units of information, and students proceeded at the instructor's pace. The results revealed little difference in course performance for the two teaching methods, except that the self-paced students performed better on the unit (chapter) tests. No differences were found between the two methods with respect to performance on the final exam, retention one year later, or average course grade. The results further revealed that the students were more satisfied with the self-paced courses than with the lecture/discussion courses. The evidence suggested that the general evaluation of the two courses favored the self-paced method. It was concluded that the self-paced course was not necessarily a better way to learn, but that students were more satisfied with the self-paced format than with the lecture/discussion style.

Comparison of Self-Paced and Lecture/Discussion Methods of Teaching General Psychology

Since 1968 when Keller published his influential article entitled "Good-Bye, Teacher...," there has been a spate of articles published on Keller's personalized system of instruction (PSI). Many variations and modifications of Keller's system have been introduced, but they all have some combination of the following elements: (1) small instructional units, (2) mastery of units to an established criterion, (3) frequent testing, (4) student-pacing, (5) immediate feedback of test results, (6) student proctors, (7) heavy reliance on reading materials to achieve instructional goals, and (8) lectures and discussions as enrichment materials and motivational devices rather than instructional tools. These components and their relative importance have been outlined elsewhere (e.g., Johnson & Ruskin, 1977; Kulik, Jaksa, & Kulik, 1978).

The motivation to conduct this study came from a desire to take advantage of the instructional research possibilities that exist under the unusual academic calendar at the host institution. Each month, the college offers a different set of courses. Each instructor offers only one course and students take only one course. The next month, a new set of courses is offered and, again, instructors teach a single course and students take only

one course. This calendar is well suited for instructional research because two sections of the same course can be offered by different instructors and their different instructional methods can be compared. Because the time frame is compressed, there are fewer opportunities for contamination (e.g., students sharing information across the two courses, unusual events that affect one group of students and not other groups). Because a new set of courses is offered each month, these "mini-semesters" can be repeated several times during the year, which creates a series of systematic replications.

The present study compared a modified Keller Plan (hereafter referred to as the self-paced plan) with a fairly traditional lecture/discussion course. The self-paced plan was a modification of Keller's approach, which incorporated the self-paced component along with small instructional units. The lecture/discussion approach did not allow for student pacing, used large instructional units, and had a larger portion of class time devoted to lecture/discussion sessions with the instructor. Neither approach used proctors and both approaches used unit mastery and immediate feedback. For both courses we were interested in course performance (scores on chapter tests and final exam performance) and student course evaluation (results of course evaluation questions). Half of the study was conducted

during the month of December when two sections of General Psychology were offered (one section as self-paced, the other section as lecture/discussion). The December arrangement was then partially replicated in May.

Method

Subjects

The subjects were 90 students enrolled in four separate sections of General Psychology during the 1982-83 academic year. There were 42 females and 48 males. The composition by class rank was: 68% freshmen, 19% sophomores, 10% juniors, and 3% seniors.

Materials

The materials for the courses consisted of a textbook (Braun & Linder, 1979), the student study guide which accompanied the text, and a set of multiple-choice questions in sufficient number to generate three, 20-item tests for each of 28 chapters. Eighteen of the 28 chapters in the text were defined as core chapters and were required of all students. The remaining 10 chapters were optional and could be used to accumulate additional points in the course. An anonymous course evaluation was administered to all students at the completion of each course (see Appendix).

Procedure

The sections of General Psychology were offered during terms 4 (December) and 9 (May) of the 1982-83 academic year. Two sections were offered term 4 and two additional sections were offered term 9. During term 4, one section (taught by Tatum) was offered under the lecture/discussion format, and another section (taught by Lenel) was offered as a self-paced course. During term 9, the self-paced section was taught by Tatum and the lecture/discussion section was taught by Astley (Lenel was not available term 9). This assignment of instructors does not completely counterbalance instructors with instructional method, but the two variables are not completely confounded. Because Tatum taught lecture/discussion (term 4) and self-paced (term 9), any effect due to the instructor variable will turn up as an interaction between method of instruction (self-paced vs. lecture/discussion) and time of year (term 4 vs. term 9).

Student proctors were not used in any of these sections. Of the 47 students who registered for General Psychology during term 4, 24 were randomly assigned to the lecture/discussion section and 23 were randomly assigned to the self-paced section. Likewise, for the 43 students who registered for term 9, 22 were randomly assigned to the lecture/discussion section and 21 were randomly assigned to the self-paced section. Students were not allowed to switch sections after these assignments were made.

On the first day of class all students present were given a 20-item sample test, which served as a pretest to check for any initial inequalities in the experimental groups. At the completion of the course, all students were required to take a comprehensive final exam over the core chapters. Approximately 1 year after the students completed the course, those who were available and willing were given the final exam again to test for retention of the material. Students were not given the exact final exam that they had received a year earlier, but were given a comparable form.

Lecture/discussion sections. The students in the lecture/discussion sections were told that they would be given three major exams plus a final exam. Each of the three major exams covered a portion (six chapters) of the core chapters. Each major exam contained 20 items on each of the six chapters covered, for a total of 120 items per exam. There were 100 test items on the final exam that did not duplicate any of the items on the major exams. The 10 optional chapters could be read and exams over this material could be taken on a chapter-by-chapter basis at the same time as the major exams. Scores on the optional chapters were used to improve the student's grade in the course and the student was in no way penalized by attempting an exam over an optional chapter. In addition to optional chapter tests, students could improve their course grade by class

attendance (approximately 2 hours per day) and by participating in research projects conducted by advanced psychology students.

All students in the lecture/discussion sections had the opportunity to retake each major exam twice. Each major exam was administered on Monday afternoon and the students could return on the next Tuesday and Wednesday afternoons to attempt the exam a second or third time. The retake exams were alternative, but comparable, forms of the original exam. Retaking the exam was at the student's discretion and each student was told that only the best exam score would be used to compute the final course grade. As an incentive to study for all exams and to encourage retaking the exams, the students were told that they would get full credit for an exam if at any point they received 90% or better. If the students failed to receive 90% or better, their score was computed based on the percentage of possible points earned. Students were not given the opportunity to retake the final exam, and the 90% rule did not apply for the final exam.

Self-paced sections. The students in the self-paced sections were told that they could progress through the course at their own rate. They were told that they were responsible for completing the 18 core chapters in a particular, predetermined sequence. As with the lecture/discussion sections, for each chapter test on which they received a score of 90% or better,

they were given full credit for that test. Again, as with the lecture/discussion sections, if students failed to achieve 90% or better on any test, their score was based on the percentage of possible points for that chapter. Each chapter test consisted of 20 items and there were three comparable sets of tests for each chapter. As with the lecture/discussion section, the self-paced students were allowed to retake the chapter tests if they desired to improve their scores, and only the highest of the three scores was used to determine the course grade. One hour in the morning and one hour in the afternoon of each class day was made available for the purpose of chapter testing. Students in the self-paced and the lecture/discussion sections were exposed to exactly the same core reading material. Furthermore, the items for the major exams in the lecture/discussion sections were exactly the same as the items used in the self-paced sections. Moreover, the self-paced and the lecture/discussion sections were exposed to the same number of items (20 items per chapter per test).

All students in the self-paced sections were required to take the final exam after completing the core chapters, and the final could be taken any time after the student completed the core chapters. The final exam was the same test given to the lecture/discussion students and contributed the same weight to their final course grade as it did in the lecture/discussion sections.

Students in the self-paced section were allowed to earn additional points toward their final course grade by taking and retaking optional chapter tests. These optional chapter tests could only be taken after the core chapters were completed. The self-paced students could also earn points through attendance at "enrichment" sessions (one-hour lectures, discussions, films, demonstrations, etc.) and participation in student research projects. These additional sources of points were comparable to those offered to the lecture/discussion students.

Results

All statistical results are reported at the .05 level of significance. The results of this study fall into two broad categories: performance outcomes and course evaluation.

Performance Outcomes

Several measures of course performance were taken. These dependent measures were examined as a function of the two primary independent variables of the study, viz, Method of Instruction (Self-Paced vs. Lecture/Discussion) and Time of Year (Term 4 vs. Term 9). Of these two variables, Method of Instruction is the most important.

Sample test. The average score on the 20-item sample test for all of the groups was 42.05%. Neither the main effect for Method of Instruction, F (1, 69) < 1.00, nor Time of Year, F (1, 69) < 1.00, was significant. The interaction between these two

variables also failed to reach statistical significance, F (1, 69) < 1.00. These findings simply reveal that there were no initial differences among the groups.

Chapter-tests. Discounting the optional chapters for the moment, the lecture/discussion sections took a total of three chapter tests and the self-paced sections took a total of 18 chapter tests. For purposes of comparison, the 18 chapter tests for the self-paced students were combined into three sets of six chapters each. These three sets of chapters corresponded to the three major exams taken by the lecture/discussion students and contained the same combination of chapters as the major exams. Table 1 shows the average test performance for the three test sets as a function of Method of Instruction and Time of Year. Because students were allowed to retake individual tests, average test performance for each student was based only on the test with highest percentage score. For the purposes of assigning a grade for each student, scores of 90% and 95% were converted to 100%. However, for the purposes of this research, all scores were the actual percentages and not converted scores. Table 1 shows that, in general, test performance is consistently better for the self-paced sections than for the lecture/discussion sections. Also, there is a tendency for term 9 students to perform better than term 4 students.

Insert Table 1 about here

A 2 X 2 factorial analysis of variance was performed on each test set. The only significant comparisons were the differences between self-paced and lecture/discussion groups on the second and third test sets, F (1, 69) = 20.43 and F (1, 73) = 7.72, respectively. None of the differences between term 4 and term 9 and none of the interactions was significant.

Optional tests. Table 2 shows the outcome for the optional chapter test performance. The table shows the average

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Insert Table 2 about here

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performance for all 10 optional tests combined as a function of Method of Instruction and Time of Year. As with the chapter tests, the average performance is the average of the tests on which the students achieved their highest percentage. Table 2 shows a pattern quite similar to Table 1. In the case of the optional chapters, both the Method of Instruction and the Time of Year variables were significant, F (1, 73) = 13.05 and 4.37, respectively. Again, the interaction failed to reach significance, F (1, 73) = 1.03. These results show that the

self-paced students performed better than the lecture/discussion students, and term 9 performed better than term 4 on the optional chapters.

Final Exam. The average final exam performance for all of the groups was 74.5%. There was no statistically significant difference between the two Methods of Instruction, F (1, 69) < 1.00, or for the two terms (4 vs. 9), F (1, 69) < 1.00. The interaction also failed to reach significance, F (1, 69) < 1.00.

Retention. Not surprisingly, it was difficult to find students after one year's time. Some of the students were seniors who graduated, and others withdrew from the college. Those who remained were disinclined to subject themselves to another final exam and resisted both monetary and humanitarian appeals. Nonetheless, a total of 24 students (10 from the lecture/discussion sections and 14 from the self-paced sections) were induced to take the final exam one year later. The results showed that the self-paced students answered 52.64% of the questions correctly and the lecture/discussion students answered 50.39%. This difference was not statistically significant, t (23) = -.049.

Because there were so few students available for the retention test, we computed a difference score between the final exam and the retention test for those specific students who did take the retention test. For the self-paced students, the

average percentage difference between their final exam performance and the retention test performance was 19.93%. For the lecture/discussion students the percentage difference was 25.5%. These difference scores for the self-paced and lecture/discussion students were not significantly different from each other, $t(23) = -1.17$.

Course grades. Table 3 shows the distribution of course grades for the four groups under investigation. The table fails

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Insert Table 3 about here

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to reveal any obvious differences among these groups. A two-factor analysis of variance, performed on the letter grades converted into numerical form, supported this conclusion by showing that the average course grade did not differ for the self-paced group compared to the lecture/discussion group, $F(1,72) < 1.00$. There were no significant differences between term 4 and term 9, $F(1, 72) < 1.00$, and the interaction between Method of Instruction and Time of Year failed to reach significance, $F(1, 72) < 1.00$.

Course Evaluation

At the end of each course, the students were given an anonymous course evaluation. A copy of this survey is reproduced in the Appendix. Rather than give the results for each of the

questions, we will summarize the results. In general, the students taking the self-paced course were more satisfied with their experience than were the students in the lecture/discussion sections. This was revealed by the question "should this course be replaced by a lecture/discussion [self-paced] course" (question 4). For the self-paced group, 79% answered "no" to this question; only 50% answered "no" for the lecture/discussion group. This difference was significant, $\underline{X}^2$ (1) = 5.24.

Other evidence that self-paced students were more satisfied than the lecture/discussion students came from an analysis of the overall course ratings (questions 7C and 8). On question 7C (a relative measure of satisfaction) the self-paced students gave the course a rating of 4.72 (on a 7-point scale) whereas the lecture/discussion students gave the course a rating of 4.11. This difference between self-paced and lecture/discussion approached statistical significance, $\underline{F}$ (1, 73) = 3.23, $p < .08$; neither the main effect for Time of Year nor the interaction between Time of Year and Method of Instruction was significant, $\underline{F}$ (1, 73) < 1.00 and $\underline{F}$ (1, 73) = 1.85 respectively. On question 8 (an absolute measure) the self-paced students gave the course a 3.97 rating (on a 5-point scale) and the lecture/discussion students gave the course a 3.43 rating. This difference between self-paced and lecture/discussion was statistically significant,

F (1, 73) = 4.49, but neither the main effect for Time of Year nor the interaction between Time of Year and Method of Instruction was significant, F (1, 73) = 2.66 and F (1, 73) = 3.80, respectively.

A few other findings are of interest. For one thing, students in the lecture/discussion sections reported that they studied significantly more hours (M = 2.77) for each chapter than the students in the self-paced sections (M = 2.24), F (1, 59) = 4.38 (question 1). This may be due to a misreading of the question, however, and the lecture/discussion students may have thought the question asked how many hours they spent studying for each major exam. If the difference is due to a misreading of the question, the results suggest that some of the students in the lecture/discussion sections did not spend much time studying for the exams, which may account for why the lecture/discussion students did not score as well as the self-paced students on the chapter tests. If the results are not due to a misreading of the question, and the lecture/discussion students did spend more time per chapter than the self-paced students, then it is very odd that the lecture/discussion students did less well on the chapter tests than did the self-paced students.

Another interesting finding was that the reported average amount of time spent studying for the final exam (question 11) was roughly equal for all sections (M = 4.26 hours). Because the

amount of time spent studying for the final was equal for the lecture/discussion group and the self-paced group, $\underline{F}$ (1, 69) < 1.00, it is not too surprising that their performance on the final exam was not different.

Finally, it should be noted that there was no significant differences between self-paced and lecture/discussion students concerning their perceptions of how worthwhile the class sessions were (question 2), $\underline{X}^2(4) = 7.12$. This lack of significance also held when we combined choices 1, 2, and 3 (all types of class sessions combined) and compared this combined score with choice 4, $\underline{X}^2(1) = 2.67$.

Discussion

The purpose of the present study was to investigate the effects of two methods of instruction on both course performance and course evaluation. The two methods of instruction were (a) a fairly traditional lecture/discussion method, with a few modifications, and (b) a fairly standard self-paced (Keller Plan) method, again with a few minor modifications. The effects of these two methods were first examined with respect to several measures of course performance. The performance measures consisted of (a) average scores on tests over the chapter material, (b) average performance on the final exam, (c) average performance on a retention test one year following the course, and (d) grade distributions for both methods of instruction. The

results showed that, in general, test performance for the chapter material was significantly better for the self-paced students, but there were no significant differences for any of the other measures.

The effects of the two instructional methods were examined with respect to several questions on an anonymous course evaluation. In general, those questions relating to student satisfaction with the course favored the self-paced course. Other questions that asked the students to estimate their study time either showed no difference or slightly favored the lecture/discussion sections.

What is the general conclusion concerning self-paced versus lecture/discussion methods? Based on these results, the conclusion would have to be that there is very little difference between the methods in terms of objective course performance reflected by examinations and course grades. There is a slight advantage to taking many exams, each covering a small unit of information, as opposed to taking fewer exams over larger units of information. But this advantage is short-lived because there was no difference between these two conditions on the final exam performance, or for the retention test one year later. The results for the final exam performance may be a bit misleading, however, because of differential withdrawal rates. Seven students withdrew from the lecture/discussion sections, whereas

only one student withdrew from the self-paced sections. If the weaker students withdrew from the lecture/discussion sections, then the final exam scores for these sections might be artificially high. In other words, the differential withdrawal rate may have disguised the fact that the self-paced students actually performed better on the final exam. If in fact the self-paced approach used here did not produce superior course performance over the lecture/discussion method, this should not be too surprising. It is generally acknowledged that the most powerful component of Keller's method with respect to student achievement is the unit mastery (see Johnson & Ruskin, 1977, p. 104). Because both methods used here had a mastery component of sorts, one would expect that student performance would be equal.

This study revealed that students like the self-paced courses better than the lecture/discussion courses, based on their answers to the course evaluation survey. These findings are consistent with other studies that have shown that self-pacing results in positive attitudes toward the course, despite the fact that there was little evidence for improved course performance (e.g., Atkins & Lockhart, 1976; Glick & Semb, 1978; Robin & Graham, 1974).

There are several possible reasons for this greater satisfaction with the self-paced method. First, students can work at their own pace and this may give them a greater sense of autonomy. Perhaps more important is the fact that students who

work hard can finish the course early and then go on to do more pleasant things. In fact, 87.5% of the self-paced students said they liked the early completion option. Because only about one-third actually did finish early, many students liked the option even though they failed to take advantage of it.

Second, although students studying under both methods had the opportunity to retake tests and achieve mastery of the material, students in the self-paced courses had more of this opportunity. Because students in the self-paced courses took more individual tests than the students in the lecture/discussion courses, there was obviously a greater opportunity to master tests. These successes were probably very reinforcing for the self-paced student. The higher frequency of reinforcement for the self-paced students did not affect their ultimate course performance, but it may have increased their liking for the course.

Third, the students had more personal contact with the instructor during the self-paced courses. The amount of total contact with the instructor was roughly equal for both instructional methods, but much of the time spent with the instructor in the self-paced course was one-on-one (e.g., discussing test questions, asking questions about difficult reading material, talking with the instructor while waiting to have a test scored). This more personal contact time may result

in a more satisfying experience for the self-paced students.

Finally, serious consideration should be given to the possibility that students don't like lectures and discussions and would rather learn the material on their own, provided someone is there to help them out if they have difficulties. If it is true that students do not generally like lectures and discussions, then one would expect the students in the lecture/discussion sections to be less satisfied with their class sessions than the self-paced students. Our results do not support this view, however, because question 2 from the course evaluation (were the class sessions worthwhile?) did not show any differences between the self-paced and the lecture/discussion classes. Our negative findings notwithstanding, other researchers have found a general lack of interest in lectures and discussions (e.g., Calhoun, 1976; Edwards, 1976; Lloyd, et al., 1972; Minke & Carlson, 1973).

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Appendix 1

Course Evaluation for General Psychology

*1. On the average, about how many hours of study did it take you to master each of the chapters?

	Self Paced	Lecture/Discussion
(1) Less than an hour.		
(2) 1-2 hours.		
(3) 2-3 hours.		
(4) 3-4 hours.		
(5) Over 5 hours.		
Average.....	2.2	2.8

2. If you attended class sessions, were they worthwhile?

(1) Yes, especially the lectures and discussions.	10.0%	16.2%
(2) Yes, especially the films.	20.0%	10.8%
(3) Yes, both the films and lecture/discussions.	55.0%	51.4%
(4) No.	7.5%	21.6%
(5) Did not attend enough to judge.	7.5%	0.0%

3. Would you prefer more courses such as this one with a (test mastery) (self-Paced) format?

(1) Yes	64.1%	55.9%
(2) No	35.9%	44.1%

*4. Should this course be replaced by a (self-paced) (lecture/discussion) course.

(1) Yes	21.1%	50.0%
(2) No	78.9%	50.0%

5. Do you believe you learn as much under this plan as you would under a (self-paced) (lecture/discussion) format?

(1) Yes	73.7%	70.6%
(2) No	26.3%	29.4%

6. How much of what you learned in this class do you think you will retain one year from today (honestly)?

(1)	Over 75%	4.9%	8.1%
(2)	Between 50%-75%	39.0%	40.5%
(3)	Between 25%-50%	48.8%	45.9%
(4)	Less than 25%	7.3%	5.4%

7. Relative to all the other courses you have taken at Cornell, rate this course on the following characteristics (circle one number only).

A. Difficulty

1	2	3	4	5	6	7
one of the easiest courses I have taken	well below average	slightly below average	average	slightly above average	well above average in difficulty	one of the most difficult courses taken

B. Interest

1	2	3	4	5	6	7
one of the least interesting and boring courses I have taken	well below average	slightly below average	average	slightly above average	well above average	one of the most interesting and fascinating courses I taken

C. Overall Evaluation

1	2	3	4	5	6	7
one of the worst courses I have taken	well below average	slightly below average	average	slightly above average	well above average	one of the best courses I have taken

Average Difficulty	4.22	4.16
Average Interest	5.20	5.14
Average Overall	4.72	4.11

*8. All things considered, how would you rate this course?

1	2	3	4	5
Excellent	Good	satisfactory	Fair	Poor

Average Rating	3.97	3.43

9. Would you recommend this course to another student who was a friend?

(1) Yes	90.2%	73.5%
(2) No	9.8%	26.5%

10. Do you plan to take one or more psychology courses in the future?
(1) none
(2) one
(3) two
(4) three or more

Average	2.21	2.39

11. How much time did you spend studying for the final exam?

(1) less than one hour.
(2) 1-2 hours.
(3) 2-3 hours.
(4) 3-4 hours.
(5) 4-5 hours.
(6) over 5 hours (how many hours?_____)

Average	4.37	4.16

12. Do you like the fact that students in this course have the option of finishing the course early? (asked of self-paced students only).

(1) Yes	87.5%
(2) No	12.5%

Note. Questions with an asterisk show a significant difference ($p < .05$) between self-paced and lecture/discussion courses.

Notes

We gratefully acknowledge the assistance of Suzette Astley in data collection and reviewing this manuscript.

Requests for reprints should be sent to B. Charles Tatum, Department of Psychology, Cornell College, Mount Vernon, IA 52314.

Table 1

Average Test Performance (Percent Correct) on Core Chapters for each Method of Instruction (Self-Paced and Lecture/Discussion) across Terms 4 and 9

	Term	
Method	4	9
	Test 1 (6 Chapters)	
Self-Paced	84.04	85.31
Lecture/Discussion	82.92	81.90
	Test 2 (6 Chapters)	
Self-Paced	84.96	86.25
Lecture/Discussion	74.21	77.88
	Test 3 (6 Chapters)	
Self-Paced	83.71	85.34
Lecture/Discussion	75.68	82.24

Table 2

Average Test Performance (Percent Correct) on Optional Chapters for both Methods of Instructions (Self-Paced and Lecture/Discussion) across Terms 4 and 9

	Term	
Method	4	9
Self-Paced	82.16	84.59
Lecture/Discussion	72.39	79.29

Table 3

Frequency Distribution of Grades for both Methods of Instruction (Self-Paced and Lecture/Discussion) across Terms 4 and 9

Grade	Term Four	Nine
	Self-Paced	
A	5	4
B	6	10
C	9	5
D	1	0
F	2	1
Withdrawal	0	1
Incomplete	0	0
	Lecture/Discussion	
A	3	4
B	4	5
C	14	5
D	0	1
F	0	2
Withdrawal	3	4
Incomplete	0	1